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## MORNING AWAKENING AND EVEN-SONG.

SECOND PAPER.<sup>1</sup>

BY HORACE W. WRIGHT.

So interesting had the procuring of definite data upon the subject of morning awakening and even-song become, that I was again moved in the season of 1912 at Jefferson Highland, New Hampshire, to obtain more records for comparison with those which had been procured there in former seasons and had served as the basis of my first paper.<sup>2</sup> The fifteen records which were then brought together had all been taken from one position, namely, the lawn with extended open space on either hand and the mountain side partially covered with mixed timber growth across the road. Here the awakening of the birds of the open country, the roadside, and the wood border had been recorded, but it remained to take position within the woods among the songsters resident there, and obtain records of their first songs. To effect this five records were taken in the midst of the fifty-acre piece of woodland lying between our buildings and the river and four others where in its lower extension it is bordered by a large field. In these locations I was brought near to some other species than those within range of hearing on the Highland. Nine other records were also procured in the former position on the lawn and at the gateway for the purpose of comparison with those previously obtained. On all occasions I was upon the chosen ground some time before the first song or call-note was given, so that I was assured that the earliest note had been heard; the time of waiting ranged from ten to thirty minutes; on many occasions it was fifteen minutes.

By these new records most of the statements of the first paper have been confirmed. Others require some modification. The flycatchers, the sparrows, and the thrushes still prove to be the earliest awakening birds, and the warblers as a family follow these. But the new positions taken, namely, in the heart of the woodland

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<sup>1</sup> Read before the Nuttall Ornithological Club, March 17, 1913, and revised in accordance with additional records obtained in the season of 1913.

<sup>2</sup> Auk, XXIX, No. 3, July, 1912, pp. 307-327.

and also in its lower reaches near the river and its border by the open field, furnished much earlier awakenings of the warblers than had been my experience on the lawn and at the roadside, where the birds were heard at longer range. The new positions taken were also near the Olive-backed Thrush, the Veery, and the Indigo Bunting, and furnished records of Scarlet Tanager, Blue-headed Vireo, Winter Wren, Golden-crowned Kinglet, and Red-breasted Nuthatch at near range.

As something is gained by closely followed up experience in the way of overlooking no voices and in enabling the ear to reach out sensitively and hear every song uttered, it proves that in the case of some of the species recorded in the first paper, besides the warblers, an advance of some minutes in the time of first song has resulted. The loud singing of several near Robins introduces a difficulty in taking all records in the open near the house, as it tends to drown out the quiet earliest utterances of other songsters. For my experiences within the woodland and at its lower border, where the voice of Robin has scarcely been heard, show that nearly all the species resident there sing earlier than their songs have been heard on the Highland, where the voice of the Robin prevails so strongly. What was expressed in the first paper concerning the order of awakening of Song Sparrow, Chipping Sparrow and Robin is further substantiated by the records of 1912 and 1913, namely, that while the Robin is the earliest conspicuous singer by reason of its loud and continuous singing, yet the Song Sparrow and the Chipping Sparrow precede the Robin in several expressions of song, which must be regarded as morning awakening singing rather than as night utterances, the latter usually being only a single expression from a single bird, while the songs of awakening follow at intervals and come from several individuals.

The records within the woodland and at its lower border, where Wood Pewee and Alder Flycatcher are resident respectively, show that these flycatchers are the earliest of all the early songsters and give them first and second places in rank. Similar results were not obtained outside the woodland, so that these species were given a lower ranking in the first paper, based on records at longer range. The Oven-bird also is now ranked by its quite usual early flight song, which is so regularly given that it will not do to

overlook it as an expression of morning awakening, although it is often followed by only one or two repetitions, or by none at all, within the next forty or fifty minutes. Then the species begins to sing its usual song at the time of the other warblers. The Indigo Bunting also has been found to better the time previously named, when heard at close range. The Olive-backed Thrush, always recorded in former seasons at long range from my position in the open, is now ranked from the several hearings within the woodlands at closest range. And the warblers, now scheduled by their first songs heard at very close range, all prove to be earlier songsters than was indicated in the first paper, although they are still found to awake comparatively late, the earliest, Maryland Yellow-throat, being preceded by twenty-two species and not singing until eighteen minutes after the Robin, and the next earliest, Chestnut-sided Warbler, not singing until eight minutes later, or twenty-six minutes after the Robin. Many additional records of the Crow show that it retains about the same relative place, namely, as the thirtieth species in the order of awakening.

The records of 1912 which have been brought together were obtained between June 20 and July 15 inclusive. One in each of the several locations will be given as illustrative of the respective order of awakening therein. Three records were taken in the heart of the woodland. One of these is: July 6, sunrise at 4.09; out at 2.21; weather fair, wind northwest calm; temperature 70°; moon in last quarter shines out clear. Await on bench by stable some first note. Frogs croak in pond-hole some distance away. Enter wood with lantern at 2.39 and proceed down the footpath. There has been no note of any kind outside the wood. Reach bench where I seat myself at 2.44; no note yet of any kind within the wood. There is only the soft music of the streamlet near by, and occasionally the sounds of a mouse running over the leaves on the ground. At 2.47 Wood Pewee sings once; again, 2.51; Oven-bird gives flight song, 2.53, nearby, without leaving perch, I am quite sure; Wood Pewee, 2.56, sings four times, and at 2.58 sings and continues; 3.04, no thrush note yet; 3.05, second Pewee sings, and the two continue, singing constantly; Olive-backed Thrush gives whistle call, 3.12, then querulous call and sings at 3.13; second bird immediately gives "pep" call and sings; at 3.15 three Olive-

oaks are singing and continue their song; at 3.20 second Oven-bird gives a flight song; at 3.23 a Veery is heard calling in the distance; at 3.24 Black-throated Blue Warbler sings; at 3.25 Blue-headed Vireo; at 3.27 Red-eyed Vireo, very quietly, but is well heard; at 3.28 Wood Thrush sings, no previous calls having been heard; Blackburnian Warbler, 3.32; Parula Warbler, 3.34; Golden-crowned Kinglet, 3.36; at 3.38 the Wood Thrush has sung but little, but is singing freely now; Oven-bird's first usual song, 3.46, and it is continued; Wood Thrush still singing, 3.48; Crow's first call, 3.51; Redstart sings, 3.53; Black-throated Green Warbler also, 3.53; extinguish lantern, 3.58; emerge from the wood at 4.04 o'clock. Two other records obtained in the same location on July 9 and 15 are in their main features similar. The three records include sixteen species. Wood Pewee was first in each instance. The second place is taken by Oven-bird with a flight song, if the records be averaged. Veery ranks third. Olive-backed Thrush comes fourth, followed by Scarlet Tanager. The sixth and seventh places are taken by Blue-headed Vireo and Black-throated Blue Warbler respectively. Wood Thrush is eighth. The next four places are filled by Red-eyed Vireo, Blackburnian Warbler, Golden-crowned Kinglet, and Parula Warbler. The Crow with its call is thirteenth and Black-throated Green Warbler, fourteenth. Sapsucker and White-breasted Nuthatch, each on a single occasion, closed the record. The July 15 record, taken when the sun rose seven minutes later than on July 6, shows a somewhat later awakening into song than the difference in time of sunrise, indicating that as the season advances to the middle of July there is a disposition to delay awakening, as the spirit of song is already waning. The weather conditions were similar on the three mornings, and all the circumstances under which the records were obtained were alike.

On four other mornings I passed down through this same woodland a mile, more or less, to a position near its border, that I might be among another and different group of songsters. The woods terminate on this, the western, side in four or five acres of saplings and bushes with only occasional large trees, this section having been cut over within a few years. It is favorable, therefore, for wood-border and bush-dwelling species. A lantern was needed to show the trail and conduct safely as well as for making the rec-

ords, and a somewhat earlier start was necessary for covering the distance. One of these records taken within the wood near its border may serve for illustration of the awakening in that location. July 2, sunrise 4.06; out at 2.25; morning fair, wind south, light; temperature 53°. Woods were entered at 2.29. No note had been heard outside, and it is silent within. Reach position at 2.44, hang lantern on a tree, and wait. Not a note from anything on the way down, nor sound of any bird moving on its perch among the branches. Evidently neither the presence of the lantern in the wood nor my movement along the path tend in any way to disturb or arouse the bird occupants. And when a train has moved noisily through the valley, as has sometimes happened before awakening time, it plainly has no effect upon the still sleeping birds. They obviously bide their time with reference to the break of day and are not responsive to factitious lights or incidental sounds. At 2.45 a cock crows in the distance; at 2.54 an Alder Flycatcher sings once; at 3.01 a Song Sparrow gives a beautiful "flight" song without leaving its perch, I think; a second Song Sparrow sings immediately; a third one farther away sings at 3.04; an Oven-bird gives flight song at 3.05; immediately following the Oven-bird's outburst, a White-throated Sparrow close by in full, clear voice gives first three notes of its song; at 3.07 a Vesper Sparrow sings in the big field just beyond the wood border and continues its singing; Oven-bird sings a second time at 3.09; Indigo Bunting gives full song, 3.10, and continues; Olive-backed Thrush gives "pep" call, 3.10, and sings, 3.11; another immediately sings, and the two continue indefinitely; soon a third bird sings; Hermit Thrush is heard singing some distance away at 3.14, more clearly at 3.15; Wood Thrush's voice at 3.16; Junco's 3.18; White-throated Sparrow sings again, 3.19, and continues, three notes of the song only; Oven-bird sings again, 3.22; Veery calls, 3.24; Magnolia Warbler sings, 3.26; Red-eyed Vireo, 3.29; Canada Warbler, 3.30; Chestnut-sided Warbler, 3.30; second bird, 3.31; Redstart, 3.32; Parula Warbler, 3.34; Blackburnian Warbler, 3.37; Black and White Warbler, 3.41; Oven-birds begin to sing frequently in regular way, 3.45; Crow's first call, 3.52 o'clock. Start back up the path at 3.55; every bird is freely singing. The new voices are those of Black-throated Blue and Black-throated Green

Warblers, of Golden-crowned Kinglet, Blue-headed Vireo, and Wood Pewee. Purple Finch is not heard until 3.59, and Red-breasted Nuthatch until 4.15, although I had been within hearing earlier. Leave wood at 4.23 o'clock. On July 4 a second similar record was obtained in the same location.

Two other records were taken on July 8 and 12, when the position chosen was just outside the woodland and within the big field. One of these will serve for illustration. July 8, sunrise 4.11; out at 2.18; fair, wind south; temperature 70°; small waning moon bright. On the ground at 2.35. Not a sound of any kind along the way. At 2.38 a Song Sparrow sings once; up to 2.48 no other note; light of dawn is now quite apparent; at 2.49 Alder Flycatcher sings once, and again at 2.52 and 2.54; Song Sparrow gives second song at 2.55 and sings again at 2.59; Vesper Sparrow sings, 2.55, and again at 3.00, 3.01, and 3.03; at 3.04 the Vesper's is the only constant voice; Oven-bird gives flight song at 3.05; second bird is heard in flight song at 3.08 and 3.15; Indigo Bunting sings, 3.08; Wood Pewee, 3.09; the voices of Alder Flycatcher and Vesper Sparrow are constant now; Hermit Thrush's nasal call is heard, 3.10 (time of song inadvertently not recorded); Olive-backed Thrush's call, 3.11, and song, 3.12; Veery calls, 3.13; Scarlet Tanager sings, 3.16; Maryland Yellow-throat once at 3.17, again at 3.19 and continues; White-throated Sparrow, 3.19, full song, two birds singing; Savannah Sparrow, 3.20, and continues; Chipping Sparrow, 3.21; Junco, 3.25; Mourning Warbler, 3.28; Canada Warbler, 3.29; Chestnut-sided Warbler, 3.30; now there is a full chorus; Black and White Warbler, 3.36; Crow calls at 3.40; Red-eyed Vireo sings, 3.43; Winter Wren, 3.48, not earlier, as I had been listening with care for the song; is constant in song after first heard; Sapsucker calls at 3.58, as it clings to a hemlock; leave field at 3.59, closing the record.

The four records taken near the lower border of the wood and at the edge of the big field show that the Alder Flycatcher is often the first bird heard, as in the midst of the woodland the Wood Pewee was first on each occasion; that Song Sparrow is usually second, when not first, with a single song followed by repetitions rather infrequently, a second bird often singing immediately or very soon after the first and also giving repetitions of its song

rather infrequently; that Wood Pewee ranks third; that the Oven-bird is often fourth with a flight song which may be given a second time somewhat later, but that it is much later when the usual form of song is sung and repeated frequently; that Vesper Sparrow often ranks fifth, when not ahead of the Oven-bird's early flight-song; that Indigo Bunting is next in the order, but is sometimes preceded by Olive-backed Thrush or Hermit Thrush; that the latter is not lower than the eighth in rank and sometimes ranks higher, being accustomed to call for some time before singing, at least five minutes and sometimes ten, and, therefore, in respect to song taking a lower place; that the White-throated Sparrow often ranks next, although sometimes much higher, being less certain to take a definite position among the early songsters than they, having been on one occasion fourth and on some others below the ninth; that the Junco sometimes ranks closely with the White-throat; that Veery and Wood Thrush may follow next as eleventh and twelfth without being entirely reliable members of the chorus; that Scarlet Tanager sometimes occupied a place very close to the last-named thrushes; that Maryland Yellow-throat comes earliest of the warblers, if Oven-bird be excepted in its early flight song; that Chipping Sparrow and Savannah Sparrow in the open fields have filled the next places, not heard, however, in their first songs, as later experience has shown; that Red-eyed Vireo ranks seventeenth, but sometimes takes a lower place among the warblers, some of which are likely to be heard earlier than Red-eye; that then follow eight warblers in rather close ranking, but according to the local records in this order: Redstart, Chestnut-sided, Magnolia, Parula, Mourning, Canada, Blackburnian, and Black and White, the range of time being eight minutes; that the Crow takes the twenty-sixth place as heard from the wood border; that the Winter Wren does not sing until almost all the warblers have sung, four records varying but eight minutes; that the Sapsucker ranks last, taking the twenty-eighth place at ten minutes before sunrise.

Still other two records were procured in the same locality on July 18 and 27, but as these dates proved rather late in the singing season for obtaining satisfactory results, the records have not been used in drawing up the averages which are submitted in tabulated form.



Nine records were also obtained upon the lawn and at the gateway in similar manner to those which formed the basis of the first paper. One of these is presented in detail. June 20, sunrise at 4.02; out at 2.34; sky partially clouded, but some stars shining; wind south calm; temperature 52°. Glimmer of dawn is apparent. Complete silence reigns, excepting the distant sound of the flowing river in the valley. Up to 2.46 no note has been heard. At 2.47 Song Sparrow sings once; at 2.55 Chipping Sparrow gives a long trill; at 2.59 light has increased a little; at 3.00 Robin calls and a minute later sings, quietly at first; at 3.04 the same Song Sparrow sings once, and again at 3.05; at the same time a second Chippy trills once; at 3.06 a second Robin sings; at 3.08 Hermit Thrush sings; at 3.09 a third Robin, and the three continue singing; at 3.11 Song Sparrow repeats song again and again; Vesper Sparrow sings, 3.12; Tree Swallow at the same time begins its joyous flight which is continued for an hour or more; at 3.13 and 3.15 Chippy repeats trill; second Hermit is singing, 3.16; at 3.18 Indigo Bunting sings several times, and the first Chippy is singing constantly; Junco sings, 3.19; Savannah Sparrow, 3.20; Bluebird, 3.21; at 3.24 extinguish light of lantern; Olive-backed Thrush sings, 3.26; pair of Chipping Sparrows drop to the driveway at 3.30; four Chippies and three Robins are now singing; second Indigo Bunting sings, 3.30; second Junco, 3.31; Crow calls from the mountain side at 3.34, two or three times only; another Crow calls in the valley, 3.38; Red-eyed Vireo sings, 3.39; Wood Pewee is heard singing at 3.40, but must have sung much earlier; two Crows on the wing, 3.41; Oven-bird's first song, 3.42; Redstart in frequent song, 3.43; several Red-eyes are singing, 3.45; Robins have ceased to sing, 3.47; a bit of rosy light on clouds in the east, 3.49; Oven-bird is now heard again and again; Black and White Warbler sings, 3.55; Goldfinch calls passing in flight, 4.04; half a dozen species follow, but the songs are not regarded as their first; so the record is closed two minutes after sunrise. It has been found that first songs or calls which have not been heard until sometime after sunrise are seldom really first songs or calls, these having been lost through distance of range. So awakening records have been closed at sunrise or shortly thereafter.

A second record on June 23 under similar conditions of weather,

when Mr. Richard M. Marble recorded the awakening with me, shows that a Song Sparrow sang once at 2.45; that a Chipping Sparrow trilled once at 2.46, followed directly by a second bird; that Song Sparrow sang again at 2.52, and a second bird twice at 2.54; that the first Robin gave a few notes at 2.54 and began to sing freely at 3.04, a second Robin beginning to sing one minute later; that Veery first called at 3.05 and sang at 3.11; that Kingbirds gave a few calls at 3.07; that Alder Flycatcher sang at 3.09; that Tree Swallow was in song flight at 3.10; that Vesper Sparrow sang at 3.11, and Bluebird at 3.12 o'clock. The record then continues in quite the usual way. On June 26, 29, July 7, 10, 13, 17, and 28 similar records were taken. The last two have not been incorporated in the averages, because they were too late in the singing season for satisfactory results.

And an occasional individual record in the illustrative records which have just been presented has not been made use of, because not in harmony with the series of records of the species. Some censorship of this kind is quite necessary when a series of records is examined, as it sometimes happens that a late record can be accounted for by the fact that the bird was not near enough to be heard in its first songs. Experience must be availed of in deciding such questions.

The period within which all the records were obtained, which have been combined, extends from the time of earliest sunrise, which is 4.02 o'clock at Jefferson, to the time of sunrise at 4.16 o'clock; the variation in sunrise, therefore, is fourteen minutes. Had it been possible to procure the desired records between June 7 and 22, there would have been no variation in the time of sunrise to reckon with. As it is, an exact basis has been established by adopting the number of minutes before or after sunrise on each day of record for the time-record of each first song and by averaging the times on this basis. The clock-time when a species awakes to sing can thus be determined for any date. I have also averaged the clock-times, as taken by the watch, of first songs of each species throughout the series of records of each to obtain the average clock-time within the prescribed period. But this is not an unvarying basis, since it varies according to the dates of records; for it makes a difference whether the records of a species are ob-

tained wholly in June on days of earliest sunrise or wholly in July on days of later sunrise. For instance, seventy minutes before sunrise on June 20 is 2.52 o'clock, while on July 15 it is 3.06 o'clock. A series of records in June would, therefore, be at an earlier hour by the watch than a series of records in July. Many species included in the list have both June and July records, but two or three have only or mostly June records, as Phoebe, Kingbird, Tree Swallow, and Bluebird, while several residents of the woodland have only July records. The clock-time named for the former, therefore, is relatively earlier than the time named for the latter. Thus the clock-record assigned each species as to first song is not so exact as the number of minutes before or after sunrise, which is exact and definite for any date. So on the latter basis the species have been ranked in the table of awakening which follows. This was not done in the first paper, but the variation in time of sunrise was regarded as negligible. I find that it should not be so regarded, if one would attain accurate data.

The weather conditions were very uniform throughout the period in which the records of 1912, which have been combined, were taken. Every morning was fair and without wind. The June days were somewhat cooler than the July days. In the earlier part of June the weather had been continuously cold with frosts on the eighth and tenth days. There was much cloudiness with frequent rains, and winds were prevalent. A hot dry spell began on July 2 and continued to July 18, modified somewhat after the tenth day. Little rain fell. The conditions up to June 20, therefore, were unfavorable for obtaining satisfactory records, but on and after that date they were very favorable. In the season of 1913 propitious weather came earlier, and the records, sixteen in number, were obtained between June 8 and July 9 inclusive.

The view was expressed in the first paper that it seemed not unlikely that bright moonlight had no effect to awaken earlier the early-singing birds. Later experiences modify somewhat this view, as on June 19, 1913, the morning after the fulling of the moon, when it shone brightly at the time of morning awakening, some of the earliest-awakening birds made a demonstration unusually early. The Tree Swallow was in the air in song flight at 2.15, forty minutes or more before his customary time; a Kingbird passed

in flight singing at 2.58, winging his way some distance, twenty-four minutes earlier than he awoke on two other near occasions; a Robin began to sing at 2.41, sixteen minutes earlier than his next earliest awakening; and a Hermit Thrush broke into song at 2.59, six minutes earlier than on any other morning. The other earliest-singing birds, however, were scarcely influenced, for Song, Chipping, Savannah, and Vesper Sparrows, Alder Flycatcher and Phoebe sang no earlier than upon other occasions when the sky was only starlit. It was an early morning for the Crow, however, for its first calls were heard at 3.17; but among nineteen records there are five others also unusually early, one occurrence being on June 10, when calls were given at 3.10, on which date the moon was in the first quarter and had set at midnight. Therefore there appears to be no generally exerted influence of the moon to awaken the birds earlier than their wont, while it seems upon the morning named to have had an influence upon the few individuals specified. It could produce an effect only upon the earliest awakening birds, if upon any, for the light of the unrisen sun is always pervasive before the later birds awake to sing.

The view was also expressed in the first paper that cloudy conditions appear not to have had an influence to any extent in delaying the time of early song. Further experience mostly confirms this view. But occasionally there is a definite exception. On July 7, 1913, the awakening was late. The previous evening having been fine, I rose for an awakening record and proceeded half a mile into open country. The sky was clouded. A change to lower temperature had been inaugurated in the night. The morning was dull and cold, and such was the day throughout. Position was taken for the record at 2.42; it was 3.10 before the first Song Sparrow sang, eighteen minutes later than the average time. The song was repeated at 3.14, and a second bird sang then. It was 3.24 before a Vesper Sparrow was heard, nineteen minutes later than usual. Chipping Sparrow did not sing until 3.31 and Phoebe until 3.33 o'clock. No voice of Robin was heard before 3.43. This was the record just where the record of June 19 had been taken when the moon filled the sky with light and some of the birds awoke so early as to break all records. I think the delay was rather more due to a chilly morning introducing forbidding

weather for the day than to a cloud-spread sky. For when the air is soft and the day is to be comfortable and agreeable although clouded, the birds have often been as early to awake as on a starlit morning. Such a morning as has been described is usually avoided for obtaining a record, as it is sure to prove not representative. And even throughout the day song is much diminished. While upon warm, agreeably clouded days the birds are wont to sing especially freely.

The order of the tabulated list is the result of combining the records obtained in the four respective locations, as described, and in other near locations in the season of 1913. I should not expect another series of similar records to give entirely the same results, for local conditions and something of individuality in the near resident birds would be likely to modify the record season by season. But a series of records such as has been procured may fairly be regarded as representative and correctly indicating the general order of awakening. Without exact time-records throughout the prosecution of the work there would be no reliable data for general facts and deductions. These are manifestly the results which are of interest and value, since thereby we attain some definiteness to the whole order of the awakening, which is not invalidated by such variations as may occur once in a while and effect to change somewhat the relative position of a species. For notwithstanding some variance in relative position which a number of records may show, there is a general trend in the order of every awakening which is definite and fixed. The first nine species in the list are always the first nine with infrequent exceptions, and they awake to sing more than an hour before sunrise. The resident flycatchers are always very early; some of them are likely to be the earliest. Song Sparrow and Chipping Sparrow are with few exceptions the earliest sparrows. White-throated Sparrow is next earliest. Robin usually follows after these earliest flycatchers and sparrows. Oven-bird sometimes precedes them all with one or several flight songs. Barn Swallow and Tree Swallow also are very early. All other members of the flycatcher, sparrow, and thrush families which are present, twelve species in all, follow in the next fifteen minutes, or from an hour to three-quarters of an hour before sunrise, the Wood Thrush, however, proving by a single

season's records to be somewhat later, and Purple Finch and Goldfinch later still. Black-billed Cuckoo and Scarlet Tanager also rank among these. The two resident vireos with all the warblers voice themselves after the flycatchers, the sparrows, the swallows, and the thrushes, except Maryland Yellow-throat and the Oven-bird in its early flight songs. The warblers awake in quick succession when their time arrives, which is not until twenty-six and thirty-five minutes after the Robin and the Song Sparrow respectively; so thirteen species of warblers are found to awake and sing within seventeen minutes of one another,—eleven of the species within eleven minutes— or, from thirty-eight to twenty-one minutes before sunrise. The Crow's first call comes somewhat midway among the warblers' first songs at thirty-four minutes before sunrise. The Purple Finch's first song is at the same time. Golden-crowned Kinglet, Winter Wren, Chickadee, and Red-breasted Nuthatch are first heard among the latest warblers. Cliff Swallow is forty-four minutes later than the Barn and Tree Swallows; House Sparrow a few minutes earlier than the Cliff Swallow. Goldfinch follows at only a few minutes before sunrise. Bobolink usually waits for sunrising. Cedar Waxwing, Belted Kingfisher, and Chimney Swift commonly remain silent until the sun is risen. White-breasted Nuthatch and the woodpeckers also have not been heard until after sunrise, with the exception of the Sapsucker and sometimes the Pileated Woodpecker, nuthatches and woodpeckers usually taking place at or near the end of the awakening list. This general order one who has some familiarity with morning awakenings may confidently look for, as he moves forth at break of day, and he will not be likely to find many wide departures from it.

The occasional early songs of Song Sparrow and Chipping Sparrow, infrequently uttered, but quite regularly given, preceding the singing of the Robin, give these sparrows rank in advance of the latter. Mr. Francis H. Allen in his paper, entitled, "More Notes on the Morning Awakening" ('The Auk,' XXX, April, 1913, p. 229), takes a different view, regarding these early occasional songs as songs of the night and not of morning awakening. The record of June 23, 1912, may serve to illustrate the reason of my view: Song Sparrow sang at 2.45, 2.52, 2.54, 2.55, and 2.57;

two Chipping Sparrows sang at 2.46; a Robin gave a few notes at 2.54 and began to sing freely at 3.04 o'clock. The record of June 10, 1905, may further illustrate the position taken: Song Sparrow sang at 2.40, 2.48, 2.55, and a second bird at 2.57; Chipping Sparrow sang at 2.48; two Robins began to sing simultaneously at 3 o'clock. And the record of July 9, 1906, may be given as a third illustration: Song Sparrow, 2.54 and 3.05; Chipping Sparrow, 2.58 and 3.05; Robin, 3.08 o'clock. The records of 1913 furnish similar testimony. On June 8 a Song Sparrow sang at 2.58 and a second bird at 2.59; Chipping Sparrow sang at 2.59 and a second bird at 3.09; Robin sang at 3.02 and a second bird at 3.10 o'clock. On June 21 a Chipping Sparrow sang at 2.34, a second bird at 2.52, and the first bird again at 2.57; Song Sparrow sang at 2.54 and a second bird at 2.55; Robin sang at 3.01, a second bird at 3.08, and a third bird at 3.12 o'clock. On June 23, in a different location from June 21 and a half-mile distant, a Chipping Sparrow sang at 2.34, again at 2.53, and a second bird at 3.01; Song Sparrow sang twice at 2.43, a second bird at 2.47, the first bird again at 2.54, and a third and a fourth bird at 2.56; Robin began to sing at 2.58 o'clock. One other supporting reason for the view that the very early songs of Song Sparrow and Chipping Sparrow are true songs of awakening may be named. The infrequent repetition of earliest song in the awakening is characteristic also of even-song, for the records show that the last songs are often given at long intervals and the final one or two renderings may be many minutes after the next preceding. This is characteristic also of the Savannah and White-throated Sparrows only to a less degree, for these also commonly give a song or two in awakening some minutes earlier than they come into constant song. The Vesper Sparrow on the contrary usually takes up free singing promptly after its first song.

A marked exception on one occasion, July 1, 1912, was a Robin beginning to sing at 2.38, or 88 minutes before sunrise. This bird continued its song for 66 minutes, or about 20 minutes longer than is the usual period of first song. A second bird, beginning to sing at 3.07, paused at 3.53, or after 46 minutes of song, that is, within the usual time limits. I have regarded this instance as an exception and not included the record in drawing up the average time of first song of the Robin, since among many records in the

season of 1912 and in former seasons there has been no similar instance. Usually a second and a third Robin sing from one to seven or eight minutes after the first bird. The full records of 1913 further confirm the priority of Chipping Sparrow as well as Song Sparrow. Eleven records of Song Sparrow average 77 minutes; ten records of Chipping Sparrow, 67 minutes; and nine records of Robin, 63 minutes. Complete records of the three species, twenty-eight in number, average for Song Sparrow 73 minutes, for Chipping Sparrow, 66 minutes, for Robin 64 minutes. These times are identical with those given in the table, which covers the seasons of 1912 and 1913 only.

The Oven-bird's very early flight song, often followed by a second rendering somewhat later or sung by a second bird, or both, precedes by forty to fifty minutes, and sometimes even more, the regular song of the species, which averages to be given at 3.34, as many records show. Thus the Oven-bird in the time of its usual song ranks with the other warblers. But it so often sings its flight song once or twice at the much earlier hour that this song is now adopted to give the species its ranking.

As to the Barn Swallow, the farm barn having been removed, which had stood in the near neighborhood and was always occupied by a colony, no satisfactory records were obtained in the season of 1912. So the eleven records of this colony in previous seasons which were combined in the first paper are retained, supplemented by three records of 1913.

A pair of Tree Swallows nested in 1912 and again in 1913 in a box fastened to the front of the stable. The records are of the male bird in song flight between May 31 and June 17, 1913, inclusive. The records of 1912 obtained later in June and in early July on account of previous unfavorable weather, because less representative, have not been retained. There are three records of 2.56, 2.57, and 2.58, or 68, 66, and 64 minutes before sunrise; and one record is extraordinarily early, namely, 2.15 on June 19, a morning of remarkable clearness with full moon and the stars shining brilliantly. I was out at 2.15 and instantly heard the swallow in its song flight. I think it had just mounted into the sky and begun its song at 107 minutes before sunrise. As I have no other record within 42 minutes as early, I am inclined to regard this extremely



early awakening as due to the brilliancy of the sky and the amount of light present, suggesting to the bird that the "time to be up" had come. I have not combined this record with the others to form the average, regarding it as exceptional.

Mr. Allen gives an early record of 2.53; his next earliest is 3.07; Dr. C. W. Townsend is quoted with a 2.58 record. These records are in agreement with my series of six, which range from 2.56 to 3.07, or from 55 to 68 minutes before sunrise. The endurance of the bird in song flight is indeed remarkable, as Mr. Allen so well states. I have not timed its length, but my impression is that it continues unabated in vigor and ebullition of joy often more than an hour.

An Olive-sided Flycatcher located for a time at the border of the lower extent of woodland in the season of 1913 and furnished two records on June 11 and 13, which average 57 minutes before sunrise and 3.04, the earlier being at 2.51, when the bird sang once and in a half-minute again, coming into frequent repetitions of his song at 3.15 o'clock. Later in the month he was not heard and must have moved on to other ground for mating.

The Olive-backed Thrush's ranking has been advanced many minutes by records of 1912, within the woodland taken near to the songsters; four in the lower woodland average 56 minutes before sunrise; three in the upper woodland, 53 minutes. The slightly earlier singing in the lower woodland near the border of the big field among sparse growth of timber may be due to the light of dawn breaking through there a few minutes earlier than it does into the heart of the woods, where the shade is dense. The earliest record in the lower section of the wood is 63 minutes, while the earliest in the upper section is 57 minutes. In each location three and sometimes four birds awoke to sing in quick succession. Either one of the call-notes, or, it may be, all three of the calls are repeated only for a minute or two preliminary to the song. On the other hand the Hermit Thrush usually calls for five minutes and sometimes for ten minutes before singing. The records of both species are based on song. Those of 1913 are in close agreement with the previous season's.

The Kingbird has not furnished entirely satisfactory records as yet. With the exception of one, which is unusually early, when

the bird passed in song flight at 2.58 on a moonlit morning, six records of close similarity average 3.16 o'clock. The very early record has been included in drawing the average, and the result of the seven records is 3.13 o'clock. Mr. Allen's average for ten records is 3.10, and Dr. Townsend is quoted with a 3.08 record. My records, therefore, with the single exception named, are uniformly later, since five minutes require to be added to them in comparing them with Boston records. And in even-song the King-bird has not been heard as late as the other flycatchers by many minutes.

In early July, 1912, the song of a Wood Thrush was heard daily in the woodland. At first the bird was located in the lower reaches of the wood and on July 2 and 4 averaged to sing 43 minutes before sunrise. Later it frequented the upper section of the wood and on July 6 and 9 the average time of first song was 34 minutes. Twice also the song entered the record taken on the lawn, namely, on July 7 and 10, when the average time was 34 minutes. The average time of the six records is 37 minutes and 3.32 o'clock. On one occasion the bird repeated its song a few times only during the first ten minutes and then sang freely for fifteen minutes. On another occasion two minutes after its first song it began to sing freely and continued singing for twenty minutes. The time given in the first paper for three June records is 36 minutes and 3.26 o'clock.

Of the ten records in 1912 of the Crow's first call, averaging 35 minutes before sunrise and 3.35 o'clock, three are very exceptional, since a call or two were heard much earlier than on the other seven occasions, namely, 69, 49, and 41 minutes before sunrise respectively. These few very early calls were not followed by others until the usual time for the Crow to be heard. Were these few exceptionally early calls disregarded, the average time of the ten records would be 28 minutes and 3.41 o'clock, and the variation in time would be but nine minutes for the ten occasions. The three exceptional records advance the average time of the Crow seven minutes. The time given in the first paper was 21 minutes and 3.44 o'clock, due to the inclusion of four unusually late records. Had these been eliminated, the remaining ten records would have averaged 24 minutes and 3.42 o'clock, the variation in time being

twelve minutes. Twenty records would then give the average time of the Crow's first call as 26 minutes and 3.42 o'clock and would place the species seven lower in the list. We, however, have given it the benefit of the three exceptionally early records of 1912, which advance the time seven minutes. The records of 1913, nine in number, average 32 minutes and 3.31, there being again in this season three records very much earlier than the other six, namely, at 52, 45, and 39 minutes. These nine records combined with the ten of 1912 give an average time of 34 minutes and 3.33 o'clock. Mr. Allen's average of thirteen records is 3.33 o'clock. There is entire agreement, therefore, in the time of the Crow's first calls, barring the difference in time between Boston and Jefferson, but as twenty-nine species in this mountain hamlet precede it in awakening song, ranging from 48 to 3 minutes earlier, I venture still to call the Crow "a comparatively late riser."

The House Sparrow's record was obtained on the four occasions: in the season of 1913 on which I procured the records of the Cliff Swallow, a half mile distant. Happily the species is no nearer our home than this! Four records of awakening with first calls were 3.38, 3.40, 3.43, and 3.45, differing but three minutes in respect to sunrise.

Cliff Swallows in a large colony of seventy-five to a hundred pairs occupy the eaves of a large farm barn half a mile away. On four mornings of 1913, June 19, 23, 30, and July 7, position was taken in front of this barn at 2.33, 2.24, 2.23, and 2.42 respectively. The first three mornings the sky was clear. The fourth morning was cloudy, and a change to low temperature had occurred during the night. The eaves were carefully watched on these occasions and no swallow came from them or voice of swallow was heard until 3.41, 3.47, 3.45, and 3.57 respectively, the delay upon the clouded morning being seven minutes later than the average time of the other three in respect to sunrise. The Cliff Swallow, therefore, differs widely from the Tree Swallow and the Barn Swallow in its time of awakening, being forty-four minutes later than they, and waiting until it is fully light or within seventeen minutes of sunrise. May this trait not be a relic of its earlier habit of nesting in holes in cliffs? Even now the retort-like entrances to their nests seclude the birds as it were within a hole. And all the hole-nesting birds,

as far as my observations have gone, are late risers, namely, the kingfisher, the swift, the woodpeckers, and the nuthatches. Perhaps the Bluebird also is later than the other thrushes because of its hole-nesting habit. My few records show it to awake 18 minutes later than the Robin and from 6 to 8 minutes later than Veery, Hermit and Olive-backed Thrushes.

There are eight records of the Goldfinch in 1912 obtained in July, averaging 4 minutes before sunrise and 4.11 o'clock, the variation in time of which, excepting one record, is but three minutes. The average of the seven records is three minutes before sunrise. On July 7 a bird began to call in a near tree by the roadside at four minutes before sunrise. I had not perceived it come on the wing, and the inference was that it had spent the night in this tree. There was a nesting in the middle of July in the orchard. On July 10, 13, and 17 the male bird's song in the air was recorded at one, one, and two minutes before sunrise respectively. On July 28, the date of earliest awakening, the call was first given thirteen minutes before sunrise, and one minute later the male bird was on the wing in jubilant song, while the female bird continued her calls in the orchard. This earliest of song records has been included notwithstanding the lateness of the date, because the song season of the Goldfinch was still at its height. It also indicates that the birds, contrary to the usual course, awoke on this date as early as they had done ten days earlier, although sunrising was ten minutes later, which accounts for the record being as early as thirteen minutes before sunrise. So the Goldfinch quietly awaits the full light of day before becoming responsive in movement and song. Six records of 1913 average seven minutes before sunrise, and the entire fourteen records, five minutes.

Belted Kingfisher nested in a gravelly bank at the roadside a quarter of a mile away in 1913. Three records were obtained on June 15, 21, and 25. On the earliest date position was taken at 2.28. The male bird came to the bank with rattle call at 3.53, but flew away without perching; at 4.02 he came again and perched on a fence post just above the nest; at 4.05 he left again. On the second occasion at 4.04 one of the pair flew from the bank calling in flight, presumably the female. At 4.10, 4.14, 4.18 and 4.21 one of the birds successively approached without coming to the bank,

being suspicious evidently on account of my presence near the nest. At 4.24 the female, presumably, returned into the hole. On the third occasion I was in position at 2.30. At 4.16 the first rattle was heard of one of the birds approaching, and a minute later perch was taken on the fence post above the nest. These records, while not wholly conclusive, indicate that the Kingfisher is a late riser like other hole-nesting birds.

The record of Chimney Swift has been transferred from the first paper, no birds having occupied near chimneys in the season of 1912. And in this season so few records of Chickadee and Bobolink were obtained, I have combined with these, supplemented by records of 1913, the records of the several previous seasons in drawing the averages of these species.

Voicings of the nuthatches have not been heard on any occasion until well toward the close of the record or until after the songs of the flycatchers, the warblers, and the thrushes had all been heard, although I have often been within range of their voices. A pair of White-breasted and two pairs of Red-breasted have been resident within the wood. The voices of the latter have followed closely after the song of the latest awakening warbler, the Bay-breast. The voice of the former has been many times heard when later rambles through the woodland have been taken, but has been recorded but once during morning awakening. The nuthatches, therefore, like the woodpeckers, appear to first voice themselves among the latest awakening species, when they are not the last of all.

The voice of the Pileated Woodpecker has been frequently heard when I have taken my customary walks in the wood in the early morning. That it has reached me but once while recording morning awakening is accepted as evidence that the species seldom voices itself until after sunrise. The time given in the first paper based on eight records, mostly obtained in June, was 11 minutes after sunrise. There are two before sunrise records of 16 and 9 minutes in 1905 and 1902. I cannot say that the Downy Woodpecker does not sometimes voice itself before sunrise in call, or song, or rappings, but the experience of many morning awakenings is that it does not.

Other species which entered into the records of 1912 and 1913,

but came within hearing in a casual way only, were: Broad-winged Hawk (*Buteo platypterus*), 4.05; Barred Owl (*Strix varia varia*) hooting at 2.18, 2.38, 2.39 and 3.01 on four several occasions; Great Horned Owl (*Bubo virginianus virginianus*) calling at 2.27 and 2.37 on two occasions; Nighthawk (*Chordeiles virginianus virginianus*) at 2.24, 2.57 and 2.58 on three occasions; Ruby-throated Hummingbird (*Archilochus colubris*), 3.55 and 4.33; Crested Flycatcher (*Myiarchus crinitus*), 5.30; Pine Siskin (*Spinus pinus*), 5.04; Rose-breasted Grosbeak (*Zamelodia ludoviciana*), 3.56; Water-thrush (*Seiurus noveboracensis noveboracensis*), 5.02; Brown Creeper (*Certhia familiaris americana*), 4.13 o'clock.

Were the species ranked in accordance with the single earliest song of each, the order would be somewhat changed but in no very essential particular, as may be seen by the table which follows. Occasionally a species would rank several higher or several lower, but these variations would not destroy the general trend as to families and their relative places in the awakening.

In drawing up the averages presented in this paper the records of seasons previous to 1912 and 1913 have not been retained, except where their use has been already mentioned. The desire was to start anew with the experience previously gained and outline as true an order as circumstances would allow. That it is not perfect and may be amended by future experience of himself and others the author is well aware and is content in the thought.

It should be borne in mind that five minutes should be added to the clock time records to obtain the corresponding time at Boston, as sunrise is five minutes earlier in Jefferson.

Attention was also given to even-song in the season of 1912. Ten records were obtained on the lawn, three in the heart of the woodland, and one at the lower border of the woods. They were taken between June 23 and July 24 inclusive, a period during which the variation in time of sunset is thirteen minutes, namely, from the time of latest sunset, which is 7.30 at Jefferson, to its setting at 7.17 o'clock. The method pursued is opposite to that followed in morning awakening, when each species is enrolled by its first song or call. In even-song each is enrolled by the time it ceased to sing or give a call-note. So it is necessary from the beginning to record each minute the birds which are singing. When one ceases,

# ORDER OF AWAKENING.

Relative order of awakening	Names of Species.	Number of records	Average number of minutes before sunrise of first song	Earliest initial song (minutes before sunrise)	Latest initial song (minutes before sunrise)	Average clock-time, A. M., of the records	Clock-time corresponding to earliest sunrise at 4.02
1	Wood Pewee ( <i>Myiochanes virens</i> )	6	82	93	75	2.46	2.40
2	Alder Flycatcher ( <i>Empidonax traillii alnorum</i> )	10	77	89	63	2.49	2.45
3	Song Sparrow ( <i>Melospiza melodia melodia</i> )	22	73	90	55	2.52	2.49
4	Oven-bird ( <i>Seiurus aurocapillus</i> )	16	70	91	54	2.55	2.52
5	Chipping Sparrow ( <i>Spizella passerina passerina</i> )	16	66	87	48	2.58	2.56
6	White-throated Sparrow ( <i>Zonotrichia albicollis</i> )	6	65	87	50	2.59	2.57
7	Robin ( <i>Planesticus migratorius migratorius</i> )	16	64	81	56	3.00	2.58
8	Barn Swallow ( <i>Hirundo erythrogastra</i> )	14	61	82	45	3.02	3.01
9	Tree Swallow ( <i>Iridoprocne bicolor</i> )	6	61	68	55	3.01	3.01
10	Vesper Sparrow ( <i>Poæceles gramineus gramineus</i> )	16	60	76	48	3.05	3.02
11	Savannah Sparrow ( <i>Passerculus sandwichensis savanna</i> )	16	59	75	46	3.06	3.03
12	Black-billed Cuckoo ( <i>Coccyzus erythrophthalmus</i> )	3	57	72	30	3.07	3.05
13	Olive-sided Flycatcher ( <i>Nuttallornis borealis</i> )	2	57	71	44	3.04	3.05
14	Olive-backed Thrush ( <i>Hylocichla ustulata swainsoni</i> )	13	54	63	47	3.13	3.08
15	Phæbe ( <i>Sayornis phæbe</i> )	16	53	68	45	3.10	3.09
16	Hermit Thrush ( <i>Hylocichla guttata pallasi</i> )	18	53	63	45	3.13	3.09
17	Indigo Bunting ( <i>Passerina cyanea</i> )	14	52	63	42	3.14	3.10
18	Veery ( <i>Hylocichla fuscescens fuscescens</i> )	16	52	59	42	3.15	3.10
19	Kingbird ( <i>Tyrannus tyrannus</i> )	7	51	64	40	3.13	3.11
20	Scarlet Tanager ( <i>Piranga erythromelas</i> )	4	51	57	42	3.21	3.11
21	Least Flycatcher ( <i>Empidonax minimus</i> )	2	51	54	47	3.13	3.11
22	Slate-colored Junco ( <i>Junco hyemalis hyemalis</i> )	15	46	60	40	3.20	3.16
23	Maryland Yellow-throat ( <i>Geothlypis trichas trichas</i> )	6	46	54	43	3.20	3.16x
24	Bluebird ( <i>Sialia sialis sialis</i> )	6	46	51	36	3.19	3.16
25	Chestnut-sided Warbler ( <i>Dendroica pensylvanica</i> )	7	38	41	36	3.27	3.24
26	Wood Thrush ( <i>Hylocichla mustelina</i> )	6	37	50	26	3.32	3.25
27	Magnolia Warbler ( <i>Dendroica magnolia</i> )	9	37	43	32	3.28	3.25
28	Mourning Warbler ( <i>Oporornis philadelphia</i> )	5	37	42	22	3.32	3.25
29	Black-throated Blue Warbler ( <i>Dendroica caerulescens caerulescens</i> )	9	37	41	28	3.32	3.25
30	Crow ( <i>Corvus brachyrhynchos brachyrhynchos</i> )	*19	34	64	17	3.33	3.28
31	Purple Finch ( <i>Carpodacus purpureus purpureus</i> )	6	33	45	21	3.29	3.29
32	Blackburnian Warbler ( <i>Dendroica fusca</i> )	14	33	41	27	3.33	3.29
33	Canada Warbler ( <i>Wilsonia canadensis</i> )	7	32	42	27	3.34	3.30
34	Red-eyed Vireo ( <i>Vireosylva olivacea</i> )	22	31	42	23	3.34	3.31
35	Redstart ( <i>Setophaga ruticilla</i> )	9	30	40	24	3.37	3.32
36	Northern Parula Warbler ( <i>Compsothlypis americana usneæ</i> )	11	29	35	23	3.38	3.33
37	Blue-headed Vireo ( <i>Lanivireo solitarius solitarius</i> )	8	28	48	13	3.39	3.34
38	Black-throated Green Warbler ( <i>Dendroica virens</i> )	7	28	33	25	3.38	3.34
39	Black and White Warbler ( <i>Mniotilta varia</i> )	4	27	35	22	3.41	3.35
40	Golden-crowned Kinglet ( <i>Regulus satrapa satrapa</i> )	9	27	34	22	3.40	3.35
41	Nashville Warbler ( <i>Vermivora rubricapilla rubricapilla</i> )	3	27	33	22	3.38	3.35
42	Winter Wren ( <i>Nannus hiemalis hiemalis</i> )	3	25	31	21	3.49	3.37
43	Myrtle Warbler ( <i>Dendroica coronata</i> )	2	24	49	2†	3.40	3.38
44	House Sparrow ( <i>Passer domesticus domesticus</i> )	*4	23	25	22	3.41	3.39
45	Chickadee ( <i>Penthestes atricapillus atricapillus</i> )	12	22	33	13	3.43	3.40
46	Bay-breasted Warbler ( <i>Dendroica castanea</i> )	6	21	32	16	3.43	3.41
47	Red-breasted Nuthatch ( <i>Sitta canadensis</i> )	*4	17	27	8	3.49	3.45
48	Cliff Swallow ( <i>Petrochelidon lunifrons lunifrons</i> )	*4	17	21	12	3.47	3.45
49	Yellow-bellied Sapsucker ( <i>Sphyrapicus varius varius</i> )	*9	7	15	1†	3.59	3.55
50	Goldfinch ( <i>Astragalinus tristis tristis</i> )	14	5	14	0	4.05	3.57
51	Cedar Waxwing ( <i>Bombycilla cedrorum</i> )	*4	1†	6	3†	4.03	4.03
52	Belted Kingfisher ( <i>Ceryle alcyon alcyon</i> )	*3	2†	9	12†	4.04	4.04
53	Bobolink ( <i>Dolichonyx oryzivorus</i> )	14	3†	28	19†	4.07	4.05
54	Chimney Swift ( <i>Chatura pelagica</i> )	10	5†	6	19†	4.10	4.07
55	White-breasted Nuthatch ( <i>Sitta carolinensis carolinensis</i> )	*1	10†	10†	10†	4.21	4.12
56	Northern Pileated Woodpecker ( <i>Phlæotomus pileatus abieticola</i> )	9	11†	16	13†	4.17	4.13
57	Downy Woodpecker ( <i>Dryobates pubescens medianus</i> )	4	19†	3†	27†	4.22	4.21

\* Call-note.

† After sunrise.

the time of its last song is thus known. And when the record of the evening has been completed, the species are ranked in their true order. The earlier records of the season were begun about 6.30, or an hour before sunset; the later about 6.45, or from thirty to forty minutes before sunset. A few species always dropped out almost at once. Other species continued their songs for some time, either singing constantly or after intervals of rest resuming their songs. Still others sang from the beginning to the close. All the species which entered into the morning awakening records are included in even-song, except House Sparrow and White-breasted Nuthatch, a full quota of voices having been heard by visiting the several locations. In the season of 1913 thirty evening records were taken, covering a wider range of location, between June 2 and July 8 inclusive. These have been combined with the records of 1912 in drawing up the averages presented in the table of even song. Records previous to these two seasons have been only exceptionally retained.

As stated in the first paper, all these records show that even-song does not extend as long after sunset as matins precede sunrise. For while the earliest nine singers in morning awakening precede sunrise by an hour to an hour and twenty minutes, the latest nine singers in even song cease singing from twenty-seven to thirty-seven minutes after sunset, a shortening of thirty-five to forty minutes. And it also continues to hold true by the records of 1912 and 1913 that the order of the awakening, generally speaking, is reversed in the evening. So the flycatchers, the sparrows, and the thrushes are the latest singers, just as they are the earliest in the morning. The thrushes, however, are invariably the last of all, Wood Pewee, Alder Flycatcher, and Scarlet Tanager only ranking with them. Five of the thrushes, Wood, Hermit, Robin, Veery, and Olive-backed, continue to sing from twenty-seven to thirty-seven minutes after sunset. The Bluebird's record does not extend as late by ten minutes. Black-billed Cuckoo's, Belted Kingfisher's, and Olive-sided Flycatcher's calls cease about the time of the Bluebird's song. The Barn Swallow's record is twenty-seven minutes after sunset. Five common sparrows, Savannah, White-throated, Vesper, Chipping, and Song, and the two flycatchers, the Least and Phoebe, cease singing just earlier, or from twenty-



seven to twenty-two minutes after sunset. Indigo Bunting and Junco records and those of the Kingbird do not extend as late. All the warblers end their songs before the sparrows and these flycatchers during the preceding twenty-seven minutes or from twenty-two minutes after sunset to five minutes before, Myrtle Warbler, however, ceasing earlier. Blue-headed Vireo ranks among the later singing warblers, while Golden-crowned Kinglet and Red-breasted Nuthatch rank with the earlier-ceasing warblers. Chimney Swift, Tree Swallow, and Bobolink become silent immediately after the going down, of the sun. Cliff Swallows keep in the air some minutes later. The Crow gives its last calls a few minutes before and seldom are any heard after sunset. At the same time, just before sunset, Purple Finch and Goldfinch end their songs, and Cedar Waxwings cease to call. Red-eyed Vireo ceases to sing fourteen minutes before sunset; Winter Wren and Chickadee still earlier. The voices of the woodpeckers are lost first of all soon after the recording has begun, or from half an hour to an hour before sunsetting, as in the morning their first calls are seldom heard until after sunrise; the Sapsucker, however, detaches itself somewhat from the group by being less late in the morning and later in the evening than the others.

Averages have been drawn in the same manner as for morning awakening, and the number of minutes before or after sunset of the last song of each has been adopted as the basis of ranking the species, as was done in matins. The average clock-time of the records, as appealing more naturally to the mind, is also named. But this is not exact, if it be unrelated to the time of sunsetting. The probable time of last song of any species for any date, however, may be easily reckoned, when the time of sunset on that day is known. For while there is not an exact gradation in a series of records of any species following the gradation of earlier sunsetting, there is a close approximation to this. So, as the sun comes to set earlier evening by evening, the record closes proportionately earlier. But, as has been already stated, it has been found when a species is nearing the end of the season of its singing that the weakening spirit of song tends to bring the birds less promptly into song in the morning and to lead them to cease singing somewhat earlier in the evening. Thus late July records usually indicate this waning

spirit and a still earlier close of even-song, except, it may be, in the case of a few species like Wood Pewee, Red-eyed Vireo, Indigo, Bunting, and Hermit Thrush, which continuing their singing well into August are vigorous singers throughout July.

The Oven-bird in even-song not infrequently makes the flight song its last utterance. When this is not its last song, it often has been given several times during the final hour of singing. On July 7, 1912, three flight songs were given at about ten minute intervals, 7.18, 7.27, and 7.37 o'clock. In 1913 on nine evenings out of seventeen a flight song was the final song and was given at 7.32, 7.35, 7.35, 7.38, 7.43, 7.44, 7.44, 7.56, and 8.01, the variation in minutes after sunset being from 9 to 16, except on the two occasions of latest song, when the rendering of the flight song was 31 and 35 minutes after sunset, corresponding in some degree to the quite usual very early song in morning awakening.

Song Sparrow and Chipping Sparrow at the close of the day also give infrequent repetitions of their songs as their earliest songs in morning awakening are infrequently given. In the case of Song Sparrow in the evening of July 24, 1912, there were but eight repetitions of the song in the last twenty-five minutes of the bird's singing. Chippies sing no hurried trills in the evening as they regularly do in the morning awakening.

Three records of the Wood Thrush in 1912 average 27 minutes after sunset and 7.55 o'clock; the latest is 34 minutes on July 5. On this occasion, as I entered the woods at 6.43, the thrush was singing, and he sang much of the time up to his last song a half-minute after 8.02, then gave a few calls which ceased at 8.03 o'clock.

Twenty records of Hermit Thrush average 33 minutes after sunset and 8.02 for calls as well as the song; the latest are 40 minutes on two occasions when the calls extended to 8.09 and 8.10, the song having ceased at 8.07 and 8.05, respectively. On one other evening the song also extended to 8.05 o'clock.

Twenty-five records of the Robin average 33 minutes after sunset and 8.01 for calls as well as song. Calls are usually given for several minutes after the birds have ceased to sing. Sometimes the song ends much earlier. The latest record is 45 minutes and 8.15 for last calls, when the song ceased but one minute earlier. The variation in time of last note is fifteen minutes, but if the latest

record of 1913 be excepted, it is but eleven minutes in the sixteen evenings. The difference in the amount of the Robin's even-song is very wide. On one occasion there was no song the entire time of the record which began at 6.30, and only infrequently was a call heard. During the time of even song on several occasions Robins have sung but little, voicing themselves intermittently only, which is very unlike their jubilant and continuous singing for forty or forty-five minutes in the morning awakening. On the other hand occasionally one of the Robins of the neighborhood becomes a very free singer in the evening.

Nineteen records of Veery average 35 minutes after sunset and 8.03 for calls as well as song. The latest record for the song is 40 minutes at 8.08 on July 8, 1913; there is a similar record for the call on June 10 at 8.05, 40 minutes. The variation in time of last song is fifteen minutes, but on fourteen of the evenings is but three minutes, constituting the Veery one of the most regular of all the species in retiring to rest.

Thirty-two records of Olive-backed Thrush average 37 minutes after sunset and 8.05 for the song; for calls one minute later. The latest is 49 minutes at 8.10 on June 4, 1913, for the song. Four other records for the song are just earlier, at 41 and 42 minutes. The variation in time of last song on twenty-seven occasions is but seven minutes, constituting the Olive-backed Thrush as well as the Veery one of the most regular of all the species in its final song before rest.

These species were only casually recorded: Sharp-shinned Hawk (*Accipiter velox*) pursued by a pair of Tree Swallows, 7.21; Barred Owl (*Strix varia varia*), 7.40; Northern Flicker (*Colaptes auratus luteus*), 7.18; Whip-poor-will (*Antrostomus vociferus vociferus*) singing from 7.28 to 7.43; Nighthawk (*Chordeiles virginianus virginianus*), 7.32 to 7.34; Ruby-throated Hummingbird (*Archilochus colubris*), 7.20 to 7.42 o'clock. The Hummingbirds visited an apple-tree in blossom in the evening of May 31, 1913. One of the pair was seen hovering over the flowers at 7.20; the second appeared five minutes later, and the two together were busily engaged sipping and humming for four or five minutes, when one flew away and the other remained until 7.42, or 24 minutes after sunset, at which time the light had become rather dim.

# ORDER OF EVEN-SONG.

Relative order of latest song	Names of Species.	Number of records	Average number of minutes before or after sunset of latest song	Latest final song (minutes before or after sunset)	Earliest final song (minutes before or after sunset)	Average clock-time, P. M., of the records	Clock-time corresponding to latest sunset at 7.30
<i>Before sunset</i>							
1	Northern Pileated Woodpecker ( <i>Phlæotomus pileatus abieticola</i> )	1	59	59	59	6.31	6.31
2	Downy Woodpecker ( <i>Dryobates pubescens medianus</i> )	2	31	23	39	6.54	6.59
3	Chickadee ( <i>Penthestes atricapillus atricapillus</i> )	2	23	19	28	7.04	7.07
4	Myrtle Warbler ( <i>Dendroica coronata</i> )	6	19	3†	33	7.06	7.11
5	Winter Wren ( <i>Nannus hiemalis hiemalis</i> )	1	17	17	17	7.12	7.13
6	Red-eyed Vireo ( <i>Vireosylva olivacea</i> )	10	14	4†	25	7.12	7.16
7	Cedar Waxwing ( <i>Bombycilla cedrorum</i> )	*4	7	3	9	7.19	7.23
8	Red-breasted Nuthatch ( <i>Sitta canadensis</i> )	*4	6	7†	13	7.22	7.24
9	Chestnut-sided Warbler ( <i>Dendroica pensylvanica</i> )	3	5	1†	8	7.23	7.25
10	Purple Finch ( <i>Carpodacus purpureus purpureus</i> )	14	4	9	20	7.23	7.26
11	Crow ( <i>Corvus brachyrhynchos brachyrhynchos</i> )	*25	4	14†	30	7.23	7.26
12	Mourning Warbler ( <i>Oporornis philadelphia</i> )	3	3	10	11	7.25	7.27
13	Golden-crowned Kinglet ( <i>Regulus satrapa satrapa</i> )	3	3	8†	11	7.21	7.27
14	Goldfinch ( <i>Astragalinus tristis tristis</i> )	18	2	12	13	7.26	7.28
15	Black-throated Green Warbler ( <i>Dendroica virens</i> )	8	0	11†	8	7.26	7.30
<i>After sunset</i>							
16	Chimney Swift ( <i>Chaetura pelagica</i> )	14	1	12	9	7.29	7.31
17	Bay-breasted Warbler ( <i>Dendroica castanea</i> )	2	2	5	1**	7.28	7.32
18	Tree Swallow ( <i>Iridoprocne bicolor</i> )	7	2	8	5	7.31	7.32
19	Yellow-bellied Sapsucker ( <i>Sphyrapicus varius varius</i> )	*2	3	14	8	7.29	7.33
20	Bobolink ( <i>Dolichonyx oryzivorus</i> )	5	3	14	5**	7.32	7.33
21	Black-throated Blue Warbler ( <i>Dendroica caerulescens caerulescens</i> )	8	4	12	3**	7.29	7.34
22	Northern Parula Warbler ( <i>Compsothlypis americana usneæ</i> )	3	5	10	2	7.33	7.35
23	Kingbird ( <i>Tyrannus tyrannus</i> )	10	5	17	6**	7.31	7.35
24	Black and White Warbler ( <i>Mniotilta varia</i> )	1	7	7	7	7.36	7.37
25	Redstart ( <i>Setophaga ruticilla</i> )	13	7	17	1**	7.35	7.37
26	Indigo Bunting ( <i>Passerina cyanea</i> )	17	9	20	1	7.37	7.39
27	Blackburnian Warbler ( <i>Dendroica fusca</i> )	11	10	17	1	7.37	7.40
28	Blue-headed Vireo ( <i>Lanivireo solitarius solitarius</i> )	3	10	29	2**	7.34	7.40
29	Cliff Swallow ( <i>Petrochelidon lunifrons lunifrons</i> )	*2	11	13	8	7.41	7.41
30	Canada Warbler ( <i>Wilsonia canadensis</i> )	2	11	15	7	7.39	7.41
31	Slate-colored Junco ( <i>Junco hyemalis hyemalis</i> )	5	12	19	5	7.41	7.42
32	Olive-sided Flycatcher ( <i>Nuttallornis borealis</i> )	1	13	13	13	7.39	7.43
33	Oven-bird ( <i>Seiurus aurocapillus</i> )	27	13	35	2	7.40	7.43
34	Belted Kingfisher ( <i>Ceryle alcyon alcyon</i> )	*2	15	16	14	7.43	7.45
35	Nashville Warbler ( <i>Vermivora rubricapilla rubricapilla</i> )	5	15	20	9	7.44	7.45
36	Bluebird ( <i>Sialia sialis sialis</i> )	2	17	22	12	7.42	7.47
37	Magnolia Warbler ( <i>Dendroica magnolia</i> )	21	17	24	10	7.45	7.47
38	Black-billed Cuckoo ( <i>Coccyzus erythrophthalmus</i> )	4	17	34	1	7.46	7.47
39	Maryland Yellowthroat ( <i>Geothlypis trichas trichas</i> )	3	22	23	19	7.49	7.52
40	Phoebe ( <i>Sayornis phæbe</i> )	2	22	24	19	7.49	7.52
41	Song Sparrow ( <i>Melospiza melodia melodia</i> )	22	23	39	14	7.51	7.53
42	Chipping Sparrow ( <i>Spizella passerina passerina</i> )	25	24	31	17	7.52	7.54
43	Least Flycatcher ( <i>Empidonax minimus</i> )	5	25	33	19	7.55	7.55
44	Vesper Sparrow ( <i>Poæetes gramineus gramineus</i> )	14	26	34	16	7.55	7.56
45	Barn Swallow ( <i>Hirundo erythrogastra</i> )	1	27	27	27	7.54	7.57
46	Savannah Sparrow ( <i>Passerculus sandwichensis savanna</i> )	10	27	34	17	7.56	7.57
47	White-throated Sparrow ( <i>Zonotrichia albicollis</i> )	11	27	43	17	7.55	7.57
48	Wood Thrush ( <i>Hylocichla mustelina</i> )	3	27	34	16	7.55	7.57
49	Wood Pewee ( <i>Myiochanes virens</i> )	25	30	39	19	7.57	8.00
50	Scarlet Tanager ( <i>Piranga erythromelas</i> )	3	31	41	26	8.00	8.01
51	Hermit Thrush ( <i>Hylocichla guttata pallasi</i> )	20	33	40	25	8.02	8.03
52	Robin ( <i>Planesticus migratorius migratorius</i> )	25	33	45	30	8.01	8.03
53	Alder Flycatcher ( <i>Empidonax trailli alnorum</i> )	4	34	39	26	8.01	8.04
54	Veery ( <i>Hylocichla fuscescens fuscescens</i> )	19	35	40	29	8.03	8.05
55	Olive-backed Thrush ( <i>Hylocichla ustulata swainsoni</i> )	32	37	49	29	8.05	8.07

\* Call-note.

† After sunset.

\*\* Before sunset.

Of the fifteen occasions of even-song in the season of 1912 Olive-backed Thrush was the latest singer on eleven, Veery on two, and Hermit on two. Holding position next to the last singer was Wood Pewee on seven occasions, Veery on five, Olive-backed Thrush on two, and Wood Thrush on one. Of twenty-three occasions of 1913 Olive-backed Thrush was the last singer on thirteen, Robin on five, Veery on three, and Hermit Thrush on two. Holding place next to the last singer was Veery on seven occasions, Olive-backed Thrush on six, Robin on five, and Hermit Thrush on five. With the western sky clear and the sunset glow remaining late, even-song has extended once to 8.15 o'clock and 45 minutes after sunset, an unusually late Robin singing a few times at 8.14 and giving final calls one minute later.

The last song of all as recorded on ten occasions in 1912 was given with a variation in time of only three minutes, namely, from thirty-seven to forty minutes after sunset, or between 8.07 and 8.10 o'clock. Twenty-three records of 1913 average 40 minutes after the latest sunsetting or 8.10 for the last note. This indicates how regular in relation to the setting of the sun is the close of even-song, and how unfailingly one of four species of thrushes ends the singing, either the Olive-back, the Veery, the Robin, or the Hermit, with twenty-four chances in thirty-eight that the Olive-back's voice will be the last. One waits in the silence for a time and then withdraws. The birds' night has closed around them.